

The Calcite Algorithms

There are two calcite algorithms provided by Balch and Gordon. One is a simple LUT based on water-leaving radiances at 443 and 555 nm and is referred to as the '2-band' algorithm. The other is a semi-analytic solution using reflectance in the red and NIR to estimate backscatter at 546nm, which is used to derive calcite concentration via an empirical relationship. This is referred to as the '3-band' algorithm.

As an initial implementation, the '3-band' algorithm was chosen. The code as delivered was in FORTRAN. Much of the FORTRAN was re-derived values already computed in the atmospheric correction code. The code was rewritten in C to eliminate duplicate computations and to allow for iteration based on a tolerance rather than an arbitrary loop count.

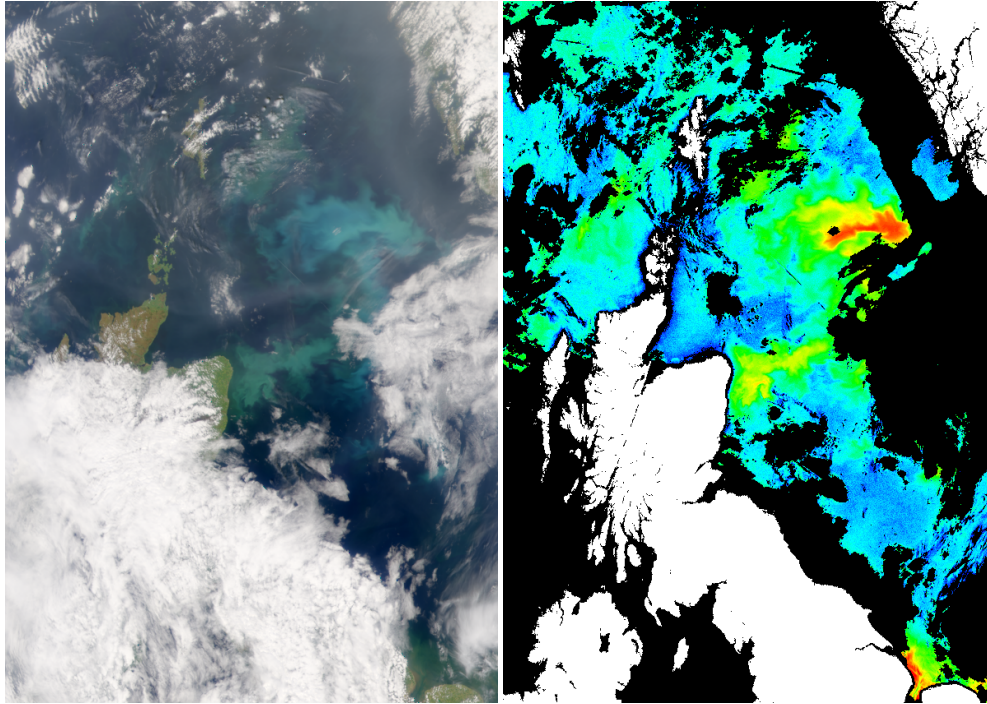
The 3-band code included an out-of-band correction to the red/NIR reflectance from SeaWiFS. This was necessary since a significant amount of signal in SeaWiFS red/NIR radiance can come from the visible spectrum. The correction in the FORTRAN was apparently too large, and was halved prior to implementation. An oob correction based on the same technique (Gordon 1995) was calculated for implementation in the C version.

The FORTRAN version was specific to SeaWiFS, the C version has been made to be sensor-independent (aside from the oob correction which is specific to SeaWiFS).

Remaining issues with 3-band algorithm:

1. As implemented, the code retrieved calcite for all valid ocean pixels. Any high backscatter environment will be seen as having high calcite concentration. A method of screening non-coccolith blooms need to be determined.
2. Since all pixels will have backscatter, a lower threshold needs to be determined. Early analysis indicates the original threshold of $0.003 \text{ moles}/m^3$ is too low, a threshold of $0.006 \text{ moles}/m^3$ may be more reasonable. More extensive analysis is required to set an appropriate threshold.
3. Currently, all particulate backscatter is assumed to be calcite-related. Non-calcite related backscattering is not accounted for (other than that due to water). Analysis is required to determine the effect of this simplification. It may be possible to include a non-calcite particulate backscattering term. An appropriate estimation of non-calcite related backscatter may affect the threshold mentioned above.
4. Algorithm output remains to be validated against in situ measurements

Images



The above image (a subset of S2003147125430.L1A.MLAC) is an example output of the calcite product. The calcite image was scaled from 0.001 to 0.1 moles/m^3 and displayed in on a log scale.